09-15-00

A

Docket No: ART-004US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :	) Art Unit:
Michele, Helmut Dr. et al.	)
Serial No.: [Not yet assigned]	)
United States Filing: 13 September 2000	)
Priority Date: 14 September 1999	)
For: ANORDNUNG ZUR AUSBILDUNG EINER BELÜFTUNGSOFFNÜNG	)

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Date: 13 Sept 2000 By: Tamara Charland

TRANSMITTAL LETTER

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Box Patent Application
Washington, D.C. 20231

Sir:

Enclosed for filing please find the United States National patent application whose German language title is, "ANORDNUNG ZUR AUSBILDUNG EINER BELÜFTUNGSOFFNÜNG", filed on behalf of Dr. Helmut Michele a German citizen, Dr. Dirk Klein a German citizen and Peter Busch a German citizen. The

German language invention includes 7 pages of Specification 2 pages of 13 claims (Patentanspruche), (2 independent and 11 dependant), 2 sheets of 3 drawings figure, and 1 page of Abstract (Zusammenfassung).

This application claims priority to German application No. 199 43 949.4 filed September 14, 1999.

The Attorney's Docket Number is ART-004US.

Kindly address all communications regarding this application to:

Kelly McCrystle
Sierra Patent Group
P.O. Box 6149
Stateline, NV 89449
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No fee is being paid at this time.

Respectfully submitted,
SIERRA PATENT GROUP

Dated: September 12, 2000

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001456

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STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR	Docket Number (Optional)

Applicant, Patentee, or Identifier: _____

Application or Patent No.: _____

Filed or Issued: _____

Title: Anordnung zur Ausbildung einer Belüftungsöffnung

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

☐ the specification filed herewith with title as listed above.

☐ the application identified above.

☐ the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☐ No such person, concern, or organization exists.

☐ Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

Dr. Helmut Michele	Dr. Dirk Klein	Peter Busch
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of inventor	Signature of inventor	Signature of inventor
8/31/00	8/31/00	8/31/00
Date	Date	Date

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STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(c))--SMALL BUSINESS CONCERN	Docket Number (Optional)

Applicant, Patentee, or Identifier: _____
Application or Patent No.: _____
Filed or Issued: _____
Title: Anordnung zur Ausbildung einer Belüftungsöffnung

I hereby state that I am
☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN ARTECH GmbH design + production in plastic
ADDRESS OF SMALL BUSINESS CONCERN Feldbachacker 10, 44149 Dortmund, Germany

I hereby state that the above identified small business concern qualifies as a small business concern as defined in 13 CFR Part 121 for purposes of paying reduced fees to the United States Patent and Trademark Office. Questions related to size standards for a small business concern may be directed to: Small Business Administration, Size Standards Staff, 409 Third Street, SW, Washington, DC 20416.

I hereby state that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

☐ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern, or organization having rights in the invention must file separate statements as to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

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☐ each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

NAME OF PERSON SIGNING MICHELE
TITLE OF PERSON IF OTHER THAN OWNER MANAGING DIRECTOR
ADDRESS OF PERSON SIGNING FELDBACHACKER 10, 44149 DORTMUND
SIGNATURE _____ DATE 8/31/00

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	)	Art Unit:	unassigned
	)		
Michele et al.	)	Examiner:	unassigned
	)		
Serial No. 09/661,121	)		
	)		
Filed: September 13, 2000	)		
	)		
Entitled: CONFIGURATION FOR FORMING A VENTILATION APERTURE	)		

CERTIFICATE OF MAILING

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Assistant Commissioner for Patents
Washington D.C. 20231

On 12/18/00 Stephanie Davis
Date Stephanie Davis

PRELIMINARY AMENDMENT

Honorable Assistant Commissioner of Patents
Box Patent Applications
Washington D.C. 20231

Dear Sir:

Kindly find included herewith a preliminary amendment containing a substitute specification. No new matter has been added to the application.

IN THE SPECIFICATION

Please find included herewith a substitute specification placing the English translated application into proper format for prosecution within the United States Patent and Trademark Office. No new matter has been added to the specification.

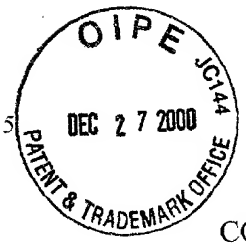
IN THE ABSTRACT

Please find included herewith the substitute specification, an abstract for the application filed concurrently with this preliminary amendment. No new matter has been added to the application with the inclusion of the abstract.

IN THE CLAIMS

The Applicant has enclosed a substitute specification including claims. In addition to the substitute specification, the Applicant has also included a marked up specification indicating the changes made to the specification, claims and abstract.

-This application is submitted in the names of Dr. Helmut Michele, Dr. Dirk Klein, and Peter Busch Assignors to Artech GmbH design + production in plastic.



SPECIFICATION

CONFIGURATION FOR FORMING A VENTILATION APERTURE

FIELD OF THE INVENTION

The invention pertains to a configuration for forming a ventilation aperture having a small cross section, whereby a sealing part is placed in a passageway and the ventilation aperture is formed between the sealing part and the inner wall of the passageway. In particular, this pertains to the ventilation aperture in the ink tank of an inkjet printer ink cartridge.

1. Prior Art.

In order to equalize pressure with the environment, liquid-filled containers from which liquid is to be drawn off during operation have a ventilation aperture to allow ambient air to flow in, since the liquid in the container would otherwise form a restraining negative pressure. This is especially applicable for the ink tanks used in ink cartridges for inkjet printers. A uniform, well-defined ink supply to the inkjet printhead presupposes pressure relationships within narrowly defined tolerance ranges. This means that an amount of air corresponding to the amount of ink that was withdrawn should flow in through the ventilation aperture as smoothly as possible.

Ventilation apertures on ink tanks have a relatively small cross section, on the order of magnitude of 1 mm^2, and are specifically, distributed over several correspondingly smaller individual apertures, if possible. In terms of quality that is as consistent as possible for ink tanks of this type, the uniform maintenance of the defined passage cross section is especially important, and specifically, and also especially in large-scale production. In view of that fact, it is of critical importance that the ventilation apertures can be reproduced as exactly as possible, and that they are as inexpensive as possible to produce, i.e., with little technical effort.

With regard to the state of the art in terms of the production of ventilation apertures, a design has already been described in EP 0 598 481 A1 in which a sealing part in the form of a sphere is pressed into a passageway in the housing wall of the ink tank. The passageway is provided with radially protruding ribs in order to hold the sphere. Between these ribs a narrow annular gap exists between the sphere and the inner wall of the passageway, which defines the ventilation aperture. This configuration is also known as a "bubble generator" that provides for the release of air bubbles for pressure equalization with the ambient atmosphere in any position of the ink tank, i.e., even when ink is resting on the ventilation aperture.

The bubble generator mentioned above has the advantage of relatively reliable functioning. To achieve this, however, high-precision manufacturing of the housing is required, and of the passageway with the apertures in particular. This is especially true of the sphere that is placed inside, and for that reason a highly accurate glass sphere is used. A simple, formed plastic part cannot be used in this configuration, which of course results in increased labor and costs.

Proceeding from the state of the art as described above, the task of the present invention is therefore to suggest an option for configuring a ventilation aperture that requires less manufacturing effort and cost, but nevertheless makes it possible to provide a ventilation aperture that can be reproduced with precision.

2. Summary of the Present Invention.

To carry out this task, the invention suggests that, starting with the features mentioned at the beginning, the sealing part should have a cylindrical stopper that is made of an elastically deformable material and can be inserted into the passageway, that has in its surface shell at least one axially continuous, channel-like depression, and the outside diameter of which, when in the unstressed state, is oversized in comparison with the inside diameter of the passageway. The characteristic feature of the configuration in accordance with the invention results from the interaction of its individual parts. Specifically, the fact that the cylindrical stopper is oversized relative to the inside diameter of the passageway in the wall means that its outside diameter is either actually larger than the inside diameter of the passageway in the wall or is at least equal in size, so that a press fit is provided whereby the stopper can be pressed into the aperture through the use of axial pressing force. Assuming that the passageway has no give in the radial direction, the elastically deformable material of the stopper will deform when it is pressed into place. While the elastic material would be able to deflect only in the axial direction in the case of a solid cylindrical stopper, in the design according to the invention it is squeezed radially and in the circumferential direction into the channel-like depressions running along the outside, so that its free passage cross section becomes smaller than when in the unstressed state. As a result of

the well-defined matching of the diameters or cross sections of the passageway, the stopper, and the depression or depressions, passage cross sections as small as desired can be predetermined for the ventilation aperture, which corresponds to the cross section of the depressions squeezed together when the stopper is pressed into place.

A particular advantage of the design in accordance with the invention lies in the fact that for the first time, both the wall with the passageway and the sealing piece in the form of the stopper according to the invention can be made as injection-molded formed plastic parts that can be made available with little manufacturing effort or cost. The passageway in the wall, of the ink container of an ink cartridge for an inkjet printer, for example, merely has a round cross section with no ribs or additional depressions as is the case in the state of the art, so that it can be reproducibly created with sufficient high precision using common manufacturing methods. For the sealing piece in accordance with the invention, i.e., the stopper provided with the channel-like depressions, the same holds true as a matter of principle. Specifically, its standard cylindrical form is modified only by the axially continuous channels or grooves that are formed into its outside, which, taking into consideration modern plastic injection-molding manufacturing techniques, can also be carried out with markedly little effort. Sufficiently high precision and reproducibility is likewise assured in every case. Specifically, during the manufacturing of the stopper the depressions are given a larger open cross section than is necessary later for the ventilation apertures formed from it, since the adjustment of this nominal cross section takes place - as has been described earlier - only when it is pressed into the passageway in the housing. The larger open cross section during the manufacturing of the depressions simplifies production when conventional injection molding techniques are used.

In comparison with the state of the art, the use of a sealing piece made of injection-molded plastic has the added advantage that no additional parts such as glass spheres, etc., have to be purchased in addition, and the manufacturing is simpler and less expensive as a result.

Moreover, the design according to the invention has the special advantage that for a given diameter of the passageway in the wall, through the design of the cross section, the depth, the shape and the number of depressions, the amount of oversize, and the choice of elastic material, it is possible to adjust the properties of the ventilation configuration, and thus the best possible adaptation to the given requirements can take place.

The entire sealing part, including stopper, is manufactured as a formed plastic part, made, for example, of polypropylene, as an injection-molded part.

Preferably, the channel-like depression is given a V-shaped cross section. This shape is easy to manage in terms of manufacturing technology, and is also especially favorable in terms of the deformation while being pressed into place in the passageway in order to form a fine gap with a defined cross section. The depression can also have a U-shaped or other cross section as well.

Preferably, the stopper is provided with a plurality of depressions distributed symmetrically over its circumference. The characteristics of the ventilation aperture can be

influenced and optimized within wide limits by the number and cross section of the individual depressions.

An advantageous further development of the invention provides that a discharge section having a larger diameter than the stopper is formed axially onto the stopper, whereby the channel-like depression passes axially through the discharge section. This discharge section is preferably mounted on the stopper as one piece by forming a shoulder on the latter, so that it forms a limit stop when the stopper is pressed into the passageway, i.e., it protrudes from the passageway. As a result of the fact that the depressions are drawn axially through the discharge section, free inward flow in the direction of the discharge section is guaranteed even if the latter is covered, for example.

A head section of a larger diameter is advantageously formed axially onto the stopper as one piece. It serves as an insertion limiter when pressed into the passageway. As a further development, this head section can also be formed axially onto the discharge section, in which it is at least as large in diameter as the latter. As a result of the channel-like depressions that end underneath the underside of the head, discharge openings that are directed radially outward are formed, which for that reason are especially reliable in operation because their simultaneous blockage is practically impossible.

The invention also includes the method for manufacturing a ventilation aperture of small cross section in a container wall, specifically, in a ink tank of an inkjet printer as was explained in some detail above. This method makes particular use of knowing how to manufacture an

easily produced depression of larger cross section when the stopper is being pressed oversized into a predetermined wall passageway, whereby the depression is squeezed together to the nominal dimension of the cross section of the ventilation aperture while reducing the cross section.

The fastening of the stopper, which, like the wall, is made of a thermoplastic, can be carried out very easily by means of ultrasonic welding, whereby only an ultrasonic excitation of the container wall must be carried out such as is already being done, for example, when the container wall is placed onto and ultrasonically welded to a container. Because of the mass ratios of wall and stopper, they are placed into relative movement, as a result of which they are nondetachably welded to one another.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following, an embodiment of an ventilation configuration in accordance with the invention is explained in more detail with the aid of the drawings. Specifically shown are:

Fig. 1: A ventilation configuration according to the invention, in disassembled state;

Fig. 2: A ventilation configuration according to the invention in Fig. 1, in assembled state;

Fig. 3: An axial view of the sealing piece according to Fig. 1 and Fig. 2.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The ventilation configuration in accordance with the invention is shown in side section view in Fig. 1 and Fig. 2, once in the disassembled state (Fig. 1) and once in the assembled state (Fig. 2), whereby it is provided in its entirety with reference number 1. It is formed from a sealing piece 2 and a passageway 3 in the wall 4 of an ink tank (not shown in more detail) of an ink cartridge for an inkjet printer. As is shown in the drawings, the sealing piece 2 is pressed into the passageway 3 from the inside of the container.

The passageway 3, which is shown in section, is cylindrical in shape with a defined inside diameter and smooth inside wall. It is formed into the wall 4, which is an injection-molded plastic part.

The sealing piece 2 is also a one-piece injection-molded plastic part, made, for example, of polypropylene. It has a cylindrical stopper 5 that has an axial discharge section 6 formed towards the top of the drawing, and head section 7 formed onto that. The head 7 has a larger diameter than the discharge section 6, which has a larger outside diameter than the stopper 5.

The stopper 5 is provided with a total of four channel-like, axially continuous depressions 8 that are evenly distributed around its outer circumference, and their configuration can be seen especially well in the axial view per Fig. 3. The V-shaped cross section can also be seen there.

The stopper 5 is oversized relative to the passageway 3, i.e., its diameter has the same size as the inside diameter of the passageway 3, or it can be as much as 0.1 mm larger, for example, or even larger.

When the sealing piece 2 with the stopper 5 is pressed into the passageway 3 - as is indicated by the arrow in Fig. 1 - up to the state shown in Fig. 2 and the discharge section 6 lies on the upper edge of the passageway 3, the stopper 5 is elastically deformed. As a result of the deflection of the material radially and in the circumferential direction, the cross section of the depressions 8 is squeezed into the final cross section of the ventilation apertures. In the assembled state as shown in Fig. 2, these ventilation apertures are formed by the depressions 8 and the associated wall sections of the passageway 3. The ventilation apertures end in discharge section 6, so that ambient air from outside can flow into the interior of the ink tank as indicated by the dotted arrows.

Both the sealing piece 2 and the wall 4 with the passageway 3 are injection molded plastic parts that are simple to manufacture. As a result of the number and the shape and dimensions of the depressions 8 plus the oversize of the stopper 5 relative to the inside diameter of the passageway 3, the desired ventilation cross section can be made variable with little manufacturing effort and cost.

The fastening of the sealing piece 2 is advantageously carried out by setting the entire wall into ultrasonic vibration. As a result of the relative movement, a welding of the outer circumference of the stopper 5 to the inner wall of the passageway 3 takes place.

Claims

1. A configuration for forming a ventilation aperture having a small cross section, whereby a sealing part is placed in a passageway and the ventilation aperture is formed between the sealing part and the inner wall of the passageway, comprising:

a said sealing part having a cylindrical stopper that is made of an elastically deformable material and can be inserted into a passageway, which has in its surface shell at least one axially continuous, channel-like depression, for which the outside diameter in an unstressed state is oversized in comparison with the inside diameter of the passageway.

2. The configuration according to claim 1, wherein said sealing part is a formed plastic part.

3. The configuration according to claim 2, characterized in that the sealing part is an injection-molded part.

4. The configuration according to claim 1, characterized in that the channel-like depression has a V-shaped cross section.

5. The configuration according to claim 1, characterized in that the channel-like depression has a U-shaped cross section.

6. The configuration according to claim 1, wherein said stopper has a plurality of depressions distributed symmetrically around its circumference.

7. The configuration according to claim 1, wherein that formed axially onto said stopper is a discharge section that has a larger outside diameter than said stopper, in which said channel-like depression passes axially through said discharge section.

8. The configuration according to claim 1, wherein a head section with a larger diameter is formed axially onto said stopper as one piece.

9. The configuration according to claim 1, wherein said head section is formed axially onto said discharge section and is at least as large in diameter as the latter.

10. The configuration according to claim 1, wherein said passageway is located in a wall of a container.

11. The configuration according to claim 10, wherein said container is a ink tank of a inkjet printer ink cartridge.

12. A method for the manufacturing of a ventilation aperture of small cross section in a container wall, whereby:

a sealing part is inserted into a passageway in the container wall, specifically, in accordance with claim 1, characterized in that a cylindrical stopper of the sealing part, which is made of

elastically deformable material and has in its surface shell at least one axially continuous, channel-like depression, and the outside diameter of which, when in the unstressed state, is oversized in comparison with the inside diameter of the passageway, is pressed axially into the passageway, in which said channel-like depression is squeezed together with the deformation of said stopper while reducing the cross section in order to form said ventilation aperture.

13. The method according to claim 12, wherein said stopper is ultrasonically welded in said passageway.

ABSTRACT

The invention pertains to a configuration for forming a ventilation aperture having a small cross section, whereby a sealing part is placed in a passageway and the ventilation aperture is formed between the sealing part and the inner wall of the passageway. In order to simplify manufacturing and, in particular, make possible the use of injection-molded plastic parts throughout, the invention suggests that the sealing part should have a cylindrical stopper that is made of an elastically deformable material and can be inserted into the passageway, and has in its surface shell at least one axially continuous, channel-like depression, the outside diameter of which, when in the unstressed state, is oversized in comparison with the inside diameter of the passageway.

VERSION WITH MARKINGS TO SHOW CHANGES

This application is submitted in the names of Dr. Helmut Michele, Dr. Dirk Klein, and Peter Busch Assignors to Artech GmbH design + production in plastic.

SPECIFICATION

CONFIGURATION FOR FORMING A VENTILATION APERTURE

FIELD OF THE INVENTION

The invention pertains to a configuration for forming a ventilation aperture having a small cross section, whereby a sealing part is placed in a passageway and the ventilation aperture is formed between the sealing part and the inner wall of the passageway. In particular, this pertains to the ventilation aperture in the ink tank of an inkjet printer ink cartridge.

1. Prior Art.

In order to equalize pressure with the environment, liquid-filled containers from which liquid is to be drawn off during operation have a ventilation aperture to allow ambient air to flow in, since the liquid in the container would otherwise form a

restraining negative pressure. This is especially applicable for the ink tanks used in ink cartridges for inkjet printers. A uniform, well-defined ink supply to the inkjet printhead presupposes pressure relationships within narrowly defined tolerance ranges. This means that an amount of air corresponding to the amount of ink that was withdrawn should flow in through the ventilation aperture as smoothly as possible.

Ventilation apertures on ink tanks have a relatively small cross section, on the order of magnitude of 1 mm^2, and are specifically, distributed over several correspondingly smaller individual apertures, if possible. In terms of quality that is as consistent as possible for ink tanks of this type, the uniform maintenance of the defined passage cross section is especially important, and specifically, and also especially in large-scale production. In view of that fact, it is of critical importance that the ventilation apertures can be reproduced as exactly as possible, and that they are as inexpensive as possible to produce, i.e., with little technical effort.

With regard to the state of the art in terms of the production of ventilation apertures, a design has already been described in EP 0 598 481 A1 in which a sealing part in the form of a sphere is pressed into a passageway in the housing wall of the ink tank. The passageway is provided with radially protruding ribs in order to hold the sphere. Between these ribs a narrow annular gap exists between the sphere and the inner wall of

the passageway, which defines the ventilation aperture. This configuration is also known as a "bubble generator" that provides for the release of air bubbles for pressure equalization with the ambient atmosphere in any position of the ink tank, i.e., even when ink is resting on the ventilation aperture.

The bubble generator mentioned above has the advantage of relatively reliable functioning. To achieve this, however, high-precision manufacturing of the housing is required, and of the passageway with the apertures in particular. This is especially true of the sphere that is placed inside, and for that reason a highly accurate glass sphere is used. A simple, formed plastic part cannot be used in this configuration, which of course results in increased labor and costs.

Proceeding from the state of the art as described above, the task of the present invention is therefore to suggest an option for configuring a ventilation aperture that requires less manufacturing effort and cost, but nevertheless makes it possible to provide a ventilation aperture that can be reproduced with precision.

2. SUMMARY OF THE PRESENT INVENTION.

To carry out this task, the invention suggests that, starting with the features mentioned at the beginning, the sealing part should have a cylindrical stopper that is made of an elastically deformable material and can be inserted into the passageway, that has in its surface shell at least one axially continuous, channel-like depression, and the outside diameter of which, when in the unstressed state, is oversized in comparison with the inside diameter of the passageway. The characteristic feature of the configuration in accordance with the invention results from the interaction of its individual parts. Specifically, the fact that the cylindrical stopper is oversized relative to the inside diameter of the passageway in the wall means that its outside diameter is either actually larger than the inside diameter of the passageway in the wall or is at least equal in size, so that a press fit is provided whereby the stopper can be pressed into the aperture through the use of axial pressing force. Assuming that the passageway has no give in the radial direction, the elastically deformable material of the stopper will deform when it is pressed into place. While the elastic material would be able to deflect only in the axial direction in the case of a solid cylindrical stopper, in the design according to the invention it is squeezed radially and in the circumferential direction into the channel-like depressions running along the outside, so that its free passage cross section becomes smaller than when in the unstressed state. As a result of the well-defined matching of the diameters or cross sections of the passageway, the stopper, and the depression or depressions, passage cross sections as small as desired can be predetermined for the ventilation aperture, which

corresponds to the cross section of the depressions squeezed together when the stopper is pressed into place.

A particular advantage of the design in accordance with the invention lies in the fact that for the first time, both the wall with the passageway and the sealing piece in the form of the stopper according to the invention can be made as injection-molded formed plastic parts that can be made available with little manufacturing effort or cost. The passageway in the wall, of the ink container of an ink cartridge for an inkjet printer, for example, merely has a round cross section with no ribs or additional depressions as is the case in the state of the art, so that it can be reproducibly created with sufficient high precision using common manufacturing methods. For the sealing piece in accordance with the invention, i.e., the stopper provided with the channel-like depressions, the same holds true as a matter of principle. Specifically, its standard cylindrical form is modified only by the axially continuous channels or grooves that are formed into its outside, which, taking into consideration modern plastic injection-molding manufacturing techniques, can also be carried out with markedly little effort. Sufficiently high precision and reproducibility is likewise assured in every case. Specifically, during the manufacturing of the stopper the depressions are given a larger open cross section than is necessary later for the ventilation apertures formed from it, since the adjustment of this nominal cross section takes place - as has been described earlier - only when it is pressed

into the passageway in the housing. The larger open cross section during the manufacturing of the depressions simplifies production when conventional injection molding techniques are used.

In comparison with the state of the art, the use of a sealing piece made of injection-molded plastic has the added advantage that no additional parts such as glass spheres, etc., have to be purchased in addition, and the manufacturing is simpler and less expensive as a result.

Moreover, the design according to the invention has the special advantage that for a given diameter of the passageway in the wall, through the design of the cross section, the depth, the shape and the number of depressions, the amount of oversize, and the choice of elastic material, it is possible to adjust the properties of the ventilation configuration, and thus the best possible adaptation to the given requirements can take place.

The entire sealing part, including stopper, is manufactured as a formed plastic part, made, for example, of polypropylene, as an injection-molded part.

Preferably, the channel-like depression is given a V-shaped cross section. This shape is easy to manage in terms of manufacturing technology, and is also especially favorable in terms of the deformation while being pressed into place in the passageway in order to form a fine gap with a defined cross section. The depression can also have a U-shaped or other cross section as well.

Preferably, the stopper is provided with a plurality of depressions distributed symmetrically over its circumference. The characteristics of the ventilation aperture can be influenced and optimized within wide limits by the number and cross section of the individual depressions.

An advantageous further development of the invention provides that a discharge section having a larger diameter than the stopper is formed axially onto the stopper, whereby the channel-like depression passes axially through the discharge section. This discharge section is preferably mounted on the stopper as one piece by forming a shoulder on the latter, so that it forms a limit stop when the stopper is pressed into the passageway, i.e., it protrudes from the passageway. As a result of the fact that the depressions are drawn axially through the discharge section, free inward flow in the direction of the discharge section is guaranteed even if the latter is covered, for example.

A head section of a larger diameter is advantageously formed axially onto the stopper as one piece. It serves as an insertion limiter when pressed into the passageway. As a further development, this head section can also be formed axially onto the discharge section, in which it is at least as large in diameter as the latter. As a result of the channel-like depressions that end underneath the underside of the head, discharge openings that are directed radially outward are formed, which for that reason are especially reliable in operation because their simultaneous blockage is practically impossible.

The invention also includes the method for manufacturing a ventilation aperture of small cross section in a container wall, specifically, in a ink tank of an inkjet printer as was explained in some detail above. This method makes particular use of knowing how to manufacture an easily produced depression of larger cross section when the stopper is being pressed oversized into a predetermined wall passageway, whereby the depression is squeezed together to the nominal dimension of the cross section of the ventilation aperture while reducing the cross section.

The fastening of the stopper, which, like the wall, is made of a thermoplastic, can be carried out very easily by means of ultrasonic welding, whereby only an ultrasonic excitation of the container wall must be carried out such as is already being done, for example, when the container wall is placed onto and ultrasonically welded to a container.

Because of the mass ratios of wall and stopper, they are placed into relative movement, as a result of which they are nondetachably welded to one another.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following, an embodiment of an ventilation configuration in accordance with the invention is explained in more detail with the aid of the drawings. Specifically shown are:

Fig. 1: A ventilation configuration according to the invention, in disassembled state;

Fig. 2: A ventilation configuration according to the invention in Fig. 1, in assembled state;

Fig. 3: An axial view of the sealing piece according to Fig. 1 and Fig. 2.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The ventilation configuration in accordance with the invention is shown in side section view in Fig. 1 and Fig. 2, once in the disassembled state (Fig. 1) and once in the assembled state (Fig. 2), whereby it is provided in its entirety with reference number 1. It is formed from a sealing piece 2 and a passageway 3 in the wall 4 of an ink tank (not shown in more detail) of an ink cartridge for an inkjet printer. As is shown in the drawings, the sealing piece 2 is pressed into the passageway 3 from the inside of the container.

The passageway 3, which is shown in section, is cylindrical in shape with a defined inside diameter and smooth inside wall. It is formed into the wall 4, which is an injection-molded plastic part.

The sealing piece 2 is also a one-piece injection-molded plastic part, made, for example, of polypropylene. It has a cylindrical stopper 5 that has an axial discharge section 6 formed towards the top of the drawing, and head section 7 formed onto that. The head 7 has a larger diameter than the discharge section 6, which has a larger outside diameter than the stopper 5.

The stopper 5 is provided with a total of four channel-like, axially continuous depressions 8 that are evenly distributed around its outer circumference, and their

configuration can be seen especially well in the axial view per Fig. 3. The V-shaped cross section can also be seen there.

The stopper 5 is oversized relative to the passageway 3, i.e., its diameter has the same size as the inside diameter of the passageway 3, or it can be as much as 0.1 mm larger, for example, or even larger.

When the sealing piece 2 with the stopper 5 is pressed into the passageway 3 - as is indicated by the arrow in Fig. 1 - up to the state shown in Fig. 2 and the discharge section 6 lies on the upper edge of the passageway 3, the stopper 5 is elastically deformed. As a result of the deflection of the material radially and in the circumferential direction, the cross section of the depressions 8 is squeezed into the final cross section of the ventilation apertures. In the assembled state as shown in Fig. 2, these ventilation apertures are formed by the depressions 8 and the associated wall sections of the passageway 3. The ventilation apertures end in discharge section 6, so that ambient air from outside can flow into the interior of the ink tank as indicated by the dotted arrows.

Both the sealing piece 2 and the wall 4 with the passageway 3 are injection molded plastic parts that are simple to manufacture. As a result of the number and the shape and dimensions of the depressions 8 plus the oversize of the stopper 5 relative to

the inside diameter of the passageway 3, the desired ventilation cross section can be made variable with little manufacturing effort and cost.

The fastening of the sealing piece 2 is advantageously carried out by setting the entire wall into ultrasonic vibration. As a result of the relative movement, a welding of the outer circumference of the stopper 5 to the inner wall of the passageway 3 takes place.

Claims

1. A configuration [Configuration] for forming a ventilation aperture having a small cross section, whereby a sealing part is placed in a passageway and the ventilation aperture is formed between the sealing part and the inner wall of the passageway, comprising: [characterized in that the] a said sealing part [(2) has] having a cylindrical stopper [(5)] that is made of an elastically deformable material and can be inserted into a [the] passageway [(3)], which has in its surface shell at least one axially continuous, channel-like depression [(8)], for which the outside diameter in an [the] unstressed state is oversized in comparison with the inside diameter of the passageway [(3)].

2. The configuration [Configuration] according to claim 1, wherein [characterized in that the] said sealing part [(2)] is a formed plastic part.

3. The configuration [Configuration] according to claim 2, characterized in that the sealing part (2) is an injection-molded part.

4. The configuration [Configuration] according to claim 1, characterized in that the channel-like depression (8) has a V-shaped cross section.

5. The configuration [Configuration] according to claim 1, characterized in that the channel-like depression (8) has a U-shaped cross section.

6. The configuration [Configuration] according to claim 1, wherein [characterized in that the] said stopper [(5)] has a plurality of depressions [(8)] distributed symmetrically around its circumference.

7. The configuration [Configuration] according to claim 1, wherein [characterized in] that formed axially onto said [the] stopper [(5)] is a discharge section [(6)] that has a larger outside diameter than said [the] stopper [(5)], in which said [the] channel-like depression [(8)] passes axially through said [the] discharge section [(6)].

8. The configuration [Configuration] according to claim 1, wherein [characterized in that] a head section [(7)] with a larger diameter is formed axially onto said [the] stopper [(5)] as one piece.

9. The configuration [Configuration] according to claim 1, wherein [characterized in that the]said head section [(7)] is formed axially onto said [the] discharge section [(6)] and is at least as large in diameter as the latter.

10. The configuration [Configuration] according to claim 1, wherein [characterized in that the] said passageway [(3)] is located in a wall [(4)] of a container.

11. The configuration [Configuration] according to claim 10, wherein [characterized in that the] said container is a [the] ink tank of a inkjet printer ink cartridge.

12. A method [Method] for the manufacturing of a ventilation aperture of small cross section in a container wall, whereby:

a sealing part is inserted into a passageway in the container wall,specifically, in accordance with claim 1, characterized in that a cylindrical stopper of the sealing part, which is made of elastically deformable material and has in its surface shell at least one axially continuous, channel-like depression, and the outside diameter of which, when in the unstressed state, is oversized in comparison with the inside diameter of the passageway, is pressed axially into the passageway, in which said [the] channel-like depression is squeezed together with the deformation of said [the] stopper while reducing the cross section in order to form said [the] ventilation aperture.

13. The method [Method] according to claim 12, wherein [characterized in that the] said stopper is ultrasonically welded in said [the] passageway.

ABSTRACT

The invention pertains to a configuration for forming a ventilation aperture having a small cross section, whereby a sealing part [(2)] is placed in a passageway [(3)] and the ventilation aperture [(1)] is formed between the sealing part [(2)] and the inner wall of the passageway [(3)]. In order to simplify manufacturing and, in particular, make possible the use of injection-molded plastic parts throughout, the invention suggests that the sealing part [(2)] should have a cylindrical stopper [(5)] that is made of an elastically deformable material and can be inserted into the passageway [(3)], and has in its surface shell at least one axially continuous, channel-like depression [(8)], the outside diameter of which, when in the unstressed state, is oversized in comparison with the inside diameter of the passageway [(3)].

In view of the foregoing amendment, an early allowance of this application is earnestly solicited. If any matters remain which could be resolved in a telephone interview between the Examiner and the Undersigned, the Examiner is hereby respectfully requested to call the undersigned to expedite resolution of any such matters.

Respectfully submitted,
Sierra Patent Group, Ltd.

Dated: December 18, 2000

By: _____
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Fig.1

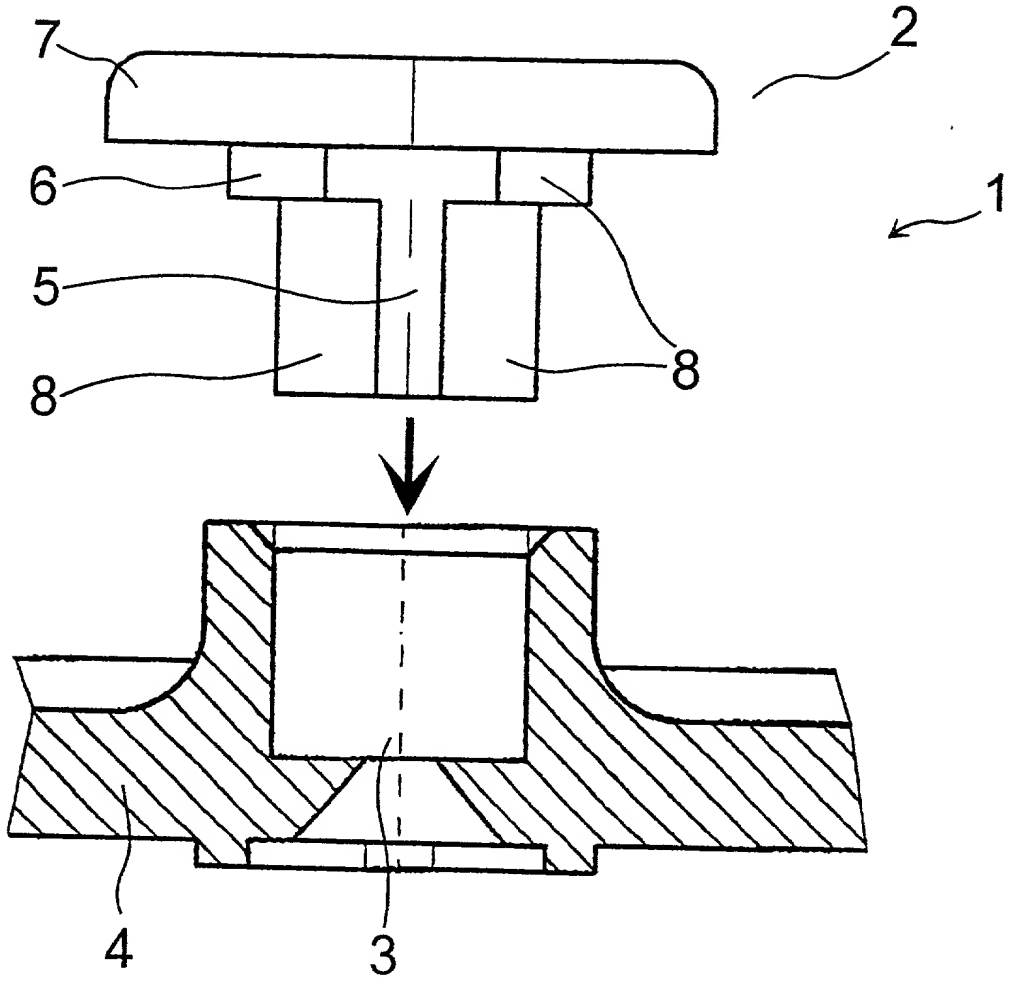


Fig.2

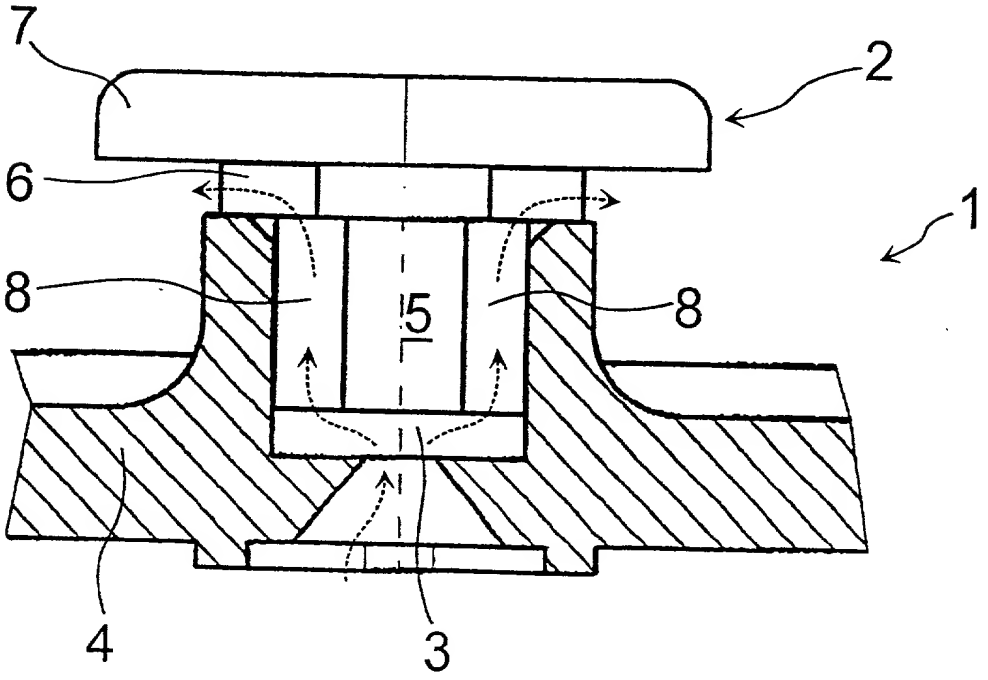
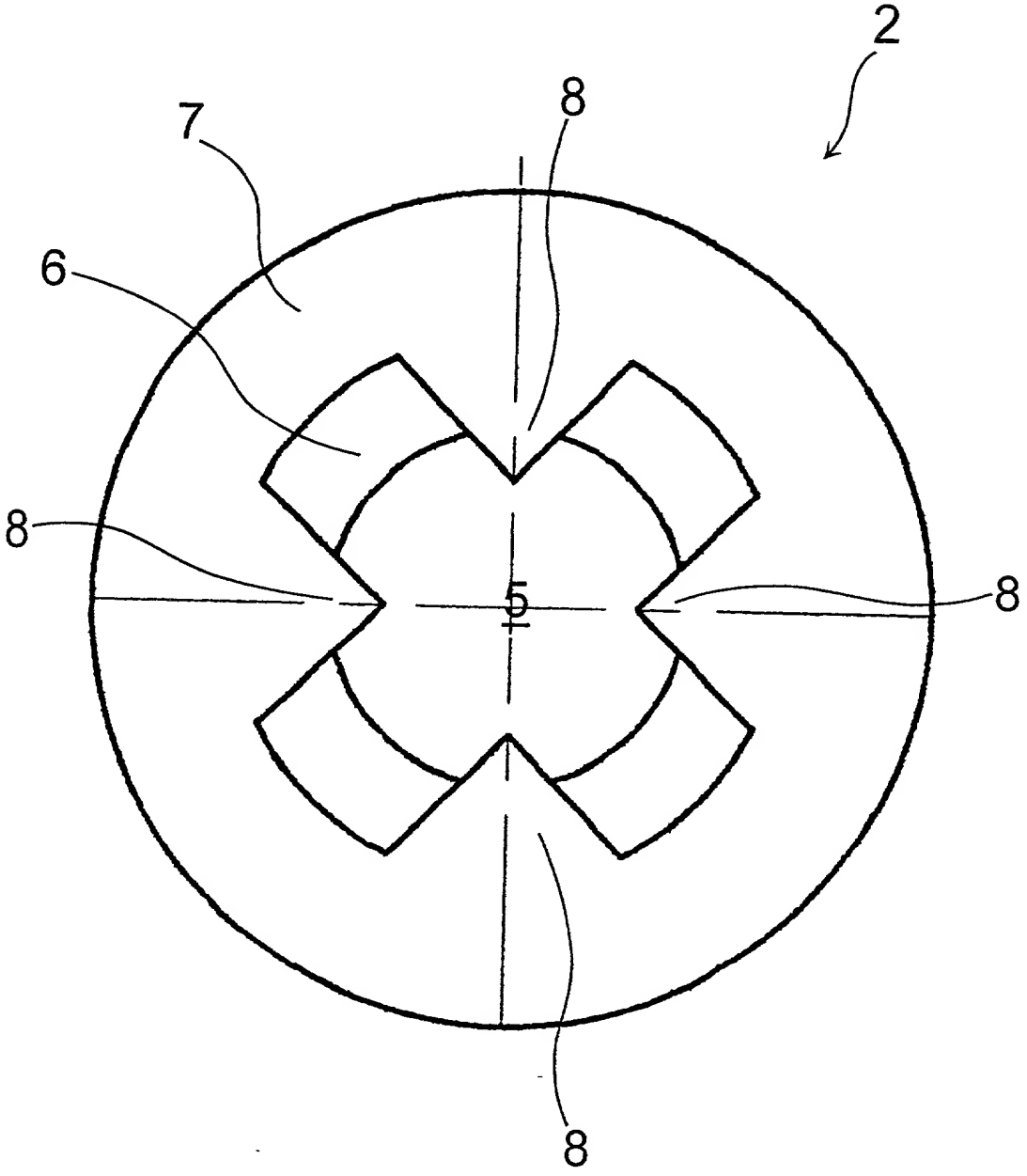


Fig.3



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_____

the specification of which is attached hereto unless the following box is checked:

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Prior Foreign Applications
(Frühere ausländische Anmeldungen)

Priority Not Claimed
Priorität nicht beansprucht

(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	
199 43 949.4	Germany	14 September 1999	☐
			☐

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Unterschrift des zweiten Erfinders Datum	Second Inventor's signature Date 8/31/00
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Staatsangehörigkeit	Citizenship German
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(Supply similar information and signature for third and subsequent joint inventors.)

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Staatsangehörigkeit	Citizenship
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